

Preliminary Results from Studying Levels of ^{15}F by $^{14}\text{O} + p$ Elastic Resonance Scattering with BEARS

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Exotic nuclei are one of the most interesting fields of study for nuclear physicists. In exploring the structures of exotic nuclei, accurate and detailed information on nuclear energy levels is needed. Proton-rich radioactive beams with their unusual Z/N ratios can be used to provide much more nuclear structure detail than has been possible with standard projectiles. The recently developed Berkeley Experiments with Accelerated Radioactive Species (BEARS) provides radioactive beams of ^{11}C , 1×10^8 particles per second (pps), and ^{14}O , 3×10^4 pps. These proton rich beams extend our ability to explore nuclei at or beyond the proton dripline. With an ^{14}O beam, we can investigate the $T_z = -3/2$ nucleus ^{15}F . ^{15}F has been studied earlier with $^{20}\text{Ne}(^3\text{He}, ^8\text{Li})^{15}\text{F}$ by Kekelis et al [1] and by Benenson et al [2]. Only two levels have been observed so far[3], the ground state and the first excited state, as shown in Table 1. Higher levels have not been investigated since the cross sections for producing ^{15}F with $^{20}\text{Ne}(^3\text{He}, ^8\text{Li})^{15}\text{F}$ are low, about 1-4 μb . Therefore, we studied levels in ^{15}F by $^{14}\text{O} + p$ thick target elastic resonance scattering, with cross sections up to 1000 mb. With a telescope (72 μm ΔE and 3000 μm E silicon detectors) placed at 0° and 200 μm polyethylene target, we first calibrated the telescope with protons from $^{14}\text{N} + p$ thick target elastic resonance scattering (see Fig. 1). Then, we measured the levels in ^{15}F by $^{14}\text{O} + p$ thick target elastic resonance scattering (see Fig. 2).

Table 1. Previous results for the Energy levels of ^{15}F

E_x in ^{15}F MeV)	J^π, T	$\Gamma_{\text{c.m.}}$ (MeV)
g.s.	$(1/2)^+; 3/2$	1.0 ± 0.2
1.3 \pm 0.1	$(5/2)^+; 3/2$	0.24 ± 0.03

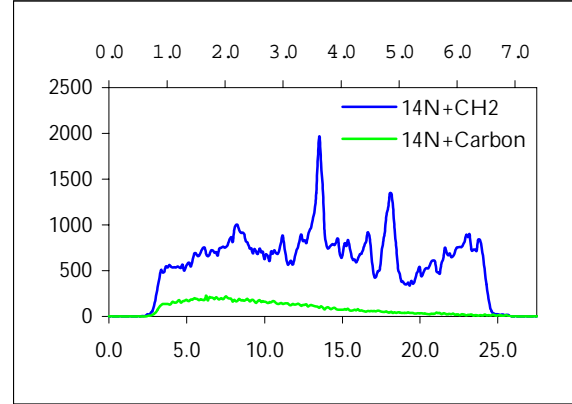


Fig. 1. Reaction $^{14}\text{N} + p \rightarrow ^{15}\text{O}$. A normalized spectrum for $^{14}\text{N} + ^{12}\text{C}$ is also shown.

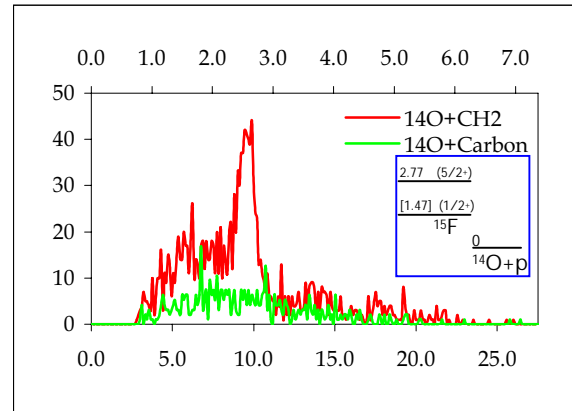


Fig. 2. Reaction $^{14}\text{O} + p \rightarrow ^{15}\text{F}$. See Fig.1 caption.

1. G. J. Kekelis, et al., Phys. Rev. C **17** (1978) 1929
2. W. Benenson, et al., Phys. Rev. C **17** (1978) 1939
3. F. Ajzenberg-Selove, Nucl. Phys. A **523** (1991) 1